A device for controlling multi-stage or dual igniter airbags in motor vehicles.

U.S. Patent Application of:

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Title of the Invention

A device for controlling multi-stage or dual igniter airbags in motor vehicles.

Cross Reference to Related Applications

Not Applicable

Statement Regarding Federally Sponsored Research or Development

Not Applicable

Description of Attached Appendix

Not Applicable

Background of the Invention

This invention relates generally to the field of passenger motor vehicles and more specifically to a device for controlling multi-stage or dual igniter airbags in motor vehicles.

Originally airbags were developed with a single detonation circuit, but the force required for an airbag to stop an occupant in the event of an accident was excessive, and resulted in many injuries and deaths; most from low speed accidents. Since 2000, airbag systems have come into use that include a multi-stage airbag to help reduce the force of airbag detonation in low speed accidents, with the intention of making airbag detonation safer for a vehicle's occupants.

Originally, a single stage airbag switch patent was awarded, and was intended to control a single stage airbag; turning it on or off depending on the preferences of the vehicle's occupant. Dual igniter airbags were introduced by some manufacturers in which there were two detonators. Patents were awarded for an airbag switch that simply put two of these single airbag switch circuits into one airbag switch box so that it could be used to manually control an airbag with two detonators such as a dual igniter airbag or a multistage airbag.

These airbag switches were developed to satisfy the minimum requirements mandated in the Federal Motor Vehicle Safety Standard (FMVSS No. 208, Occupant Crash Protection).

Multi-stage airbag switches also used separate resistors and fuses for each bypass circuit, increasing cost and potential incidence of errors in manufacture, and also rendering the airbag switch useless to perform its required function once it had passed a detonation charge in the "Airbag Off" position, and a fuse had opened in the bypass circuit. This made it necessary to replace the entire airbag switch once a detonation impulse passed through the bypass circuits.

This invention includes only one resistor common to all bypass circuits, and no fuses. In addition, one embodiment includes additional filter circuits to minimize the possibility of accidental detonation of the airbag from inductive reactance, including from radio waves.

Brief Summary of the Invention

The primary object of the invention is To provide a multi-stage airbag switch, that

requires fewer parts in order to perform its basic functions.

Another object of the invention is to provide a novel electronic circuit in conjunction with the airbag switch to filter out electromagn tic waves from other sources, such as from radio waves, and therefore to reduce the possibility of accidental detonation of the airbag from inductive reactance.

A further object of the invention is to provide an airbag switch with longer life and that does not have to be replaced each time a detonation current passes through the bypass circuit.

Other objects and advantages of the present invention will become apparent from the following descriptions, taken in connection with the accompanying drawings, wherein, by way of illustration and example, an embodiment of the present invention is disclosed.

In accordance with a preferred embodiment of the invention, there is disclosed a device for controlling a multi-stage or dual igniter airbag in motor vehicles comprising: A bypass circuit which only contains one common resistor for simultaneous use by multiple circuits within an airbag switch, as well as circuitry to filter out possible unintentional currents from inductive reactance.

Brief Description of the Drawings

The drawings constitute a part of this specification and include exemplary embodiments to the invention, which may be embodied in various forms. It is to be understood that in some instances various aspects of the invention may be shown exaggerated or enlarged to facilitate an understanding of the invention.

Figure 1 is a perspective view of the airbag switch box.

Figure 2 is an electrical schematic of the circuit embodied in the invention.

Detailed Description of the Preferred Embodiments

Detailed descriptions of the preferred embodiment are provided herein. It is to be understood, however, that the present invention may be embodied in various forms. Therefore, specific details disclosed herein are not to be interpreted as limiting, but rather as a basis for the claims and as a representative basis for teaching one skilled in the art to employ the present invention in virtually any appropriately detailed system, structure or manner.

Turning first to **Fig 1** there is shown a device **21** (see Fig. 2) for controlling the deployment of a multistage airbag in a motor vehicle. The device has a rectangular housing **22** with a two position ("on and off") key-operated switch **23** on the front face. A manual engagement actuaor, such as a removable key **24** is provided for actuating the switch mechanism **23**. The device includes an optical device such as one light emitting diode (LED) **25,** for visual confirmation of the switch position selected. When the airbag is turned off, the LED **25** is illuminated as long as the vehicle's ignition is turned on. When the airbag is active there is no light. The exterior case of the switch includes lettering to indicate whether the airbag is active or disconnected.

Turning to **Fig 2**, an electrical diagram for connecting switch device **21** to a multi-stage airbag module **101** having two igniters **102, 103** is shown. Typically, a sensor in the vehicle will determine the severity of the impact of the vehicle during an accident. If the impact is less severe, only one of the igniters **102** or **103** ignites to inflate airbag **101**. If the impact is more severe, both igniters **102, 103** ignite to inflate the airbag **101**. Each

igniter is connected through a pair of wires **111, 112** and **115, 116** respectively to the vehicle's airbag controller **119**, which monitors and controls the operation of the vehicle's Supplemental Restraint System, among other functions, including the airbag module **101** and its igniters **102,103**. Without device **21**, the airbag controller would be connected directly to the multi-stage airbag through wires **111,112** and **115, 116.** However, with device **21,** wires **111** and **115** are interrupted at breaks **121** and **122**, respectively and connected to device **21**.

In the embodiment shown in **Fig. 2**, switch **23** is a four-pole, double-throw switch. Switch **23** has a first pole **31** connected with wire **133** to the LED **25** and its resistor **151** and then to the vehicle's ground **120.** This circuit is completed when pole **31** connects wire **133** to an external power source **110** through wire **134**.

The preferred embodiment is shown which comprises multiple circuits simultaneously switched by the keyed four pole switch **23** for controlling multiple igniter airbags in motor vehicles. The device comprises multiple bypass circuits **136,139,142** to simulate each of the airbag's igniters when the airbag **101** is switched OFF, and all bypass circuits share one, common resistor **160**. The device also contains a separate circuit to indicate the status of the airbag by illuminating the LED **25** when the airbag is turned off, as long as the vehicle's ignition is On.

One feature of the invention is the inclusion of a fourth circuit **141, 142** and **143** within the device **21**, also simultaneously controlled by the fourth pole **30** of the switch mechanism **23**. This fourth circuit can be used to control the third stage detonator of a

three stage airbag (not shown) or a separate one-stage airbag **190** with igniter **191** in the vehicle such as a side airbag.

In operation, device **21** may be turned off to prevent the airbag module **101** from deploying in the event of a collision, or turned on to allow module **101** to deploy. When device **21** is "On" (**Fig. 2**), poles **30,31,32, and 33** are simultaneously thrown or actuated to the upper position. This allows the circuits to be completed between the vehicle's airbag controller, **119** and the airbag **101** through wires **138, 140** and **135, 137**. At the same time, pole **31** connects to the terminal for wire **132**, so that the L.E.D. **25** is not illuminated. In the fourth circuit, wire **141** is connected to wire **143** by pole **30** to activate a third airbag detonator **191.**

When device **21** is "Off" (not shown), poles **30,31,32,** and **33** are simultaneously thrown to the lower position. This interrupts the circuit between the vehicle's airbag controller **119** and the airbag **101** at breaks **121** and **122**. This connects wires **135, 138** and **141** to the bypass circuit wires **136,139** and **142** respectively, which pass through the common bypass resistor **160** and back into the airbag detonation circuit. In effect, this shunts bypass resistor **160** between wires **111** and **112,** and between wires **115** and **116.** With the airbag switch in the OFF position, the fourth pole **30** interrupts the circuit through wire **117** from the airbag controller **119** to the single stage airbag detonator **191**, or third stage of a three stage airbag (not shown) at break **123** and completes the circuit from wire **141** to wire **142**, then through the common resistor **160** to wire **118**. Pole **31** simultaneously activates the LED **25** to emit a yellow light to indicate that the airbag is turned "Off" and will not deploy.

The preferred embodiment includes wires **182,152 and 144** which connect wires **143, 140** and **137** to capacitors **146,154 and 180** respectively while the airbag switch **23** is

in the ON position, and then to ground **181** which will filter out current induced by inductive reactance, which could cause unintentional airbag detonation. At the same time, wires **135,138 and 141** are connected to wires **183,153,and 145** completing electrical conductivity between the airbag detonators **102, 103** and the airbag controller **119** and between detonator **191** and the airbag controller **119.**

While the invention has been described in only one of its forms, it should be apparent to those skilled in the art that it is not so limited, but is susceptible to various changes without departing from the scope of the invention. The device shown and described could be configured for more airbag modules by adding more poles and bypass circuits connected to use the one bypass resistor **160**.

While the invention has been described in connection with a preferred embodiment, it is not intended to limit the scope of the invention to the particular form set forth, but on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.